ORIGINAL ARTICLE

Current Trends in the Length of Stay in Neurological Early Rehabilitation

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SUMMARY

Background: Neurological early rehabilitation (phase B) is an integral component of the phase model of the German Federal Rehabilitation Council (Bundesarbeitsgemeinschaft für Rehabilitation, BAR). We studied the current trend in patients' length of stay.

Methods: This study included 2060 cases of the BDH-Klinik Hessisch Oldendorf (a neurological rehabilitation clinic) from 2005 to 2008 that fulfilled the structural characteristics of item 8-552 of the German coding system for operations and procedures (Operationen- und Prozedurenschlüssel, OPS), which codes for neurological and neurosurgical early rehabilitation. We studied the parameters age, sex, length of stay, type of discharge, diagnoses, and morbidity. 75.7% of the collective carried a diagnosis of cerebral ischemia, traumatic brain injury, or intracerebral hemorrhage.

Results: The mean length of stay over the entire period of the study was 44.6 days. A successive reduction of the mean length of stay from 2005 to 2008 was evident, from 46.8 days in 2005 to 37.5 in 2008 ($p < 0.001$). The morbidity, too, declined over the period of the study. 76.4% of the cases analyzed stayed in hospital for at least the minimum of 8 weeks proposed by the BAR. 39.5% of the patients improved to such an extent in phase B that they were able to be transferred to a further rehabilitation facility, while about one patient in five was transferred from early rehabilitation to a nursing facility. The mortality was 0.9%. Although the early rehabilitation procedure was correctly coded, a total of 60 different diagnosis-related groups (DRGs) were applied.

Conclusion: These data support the BAR's recommendation for a minimum length of stay of 8 weeks in phase B. The observed shortening of the length of stay was found to be primarily the result of a reduction in morbidity during early rehabilitation. This, in turn, may well be due to a selection effect of the early rehabilitation procedure code 8-552.

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Neurological early rehabilitation in Germany is embedded in the six-phase model of the German Federal Rehabilitation Council (Bundesarbeitsgemeinschaft für Rehabilitation, BAR) for the rehabilitation of patients with severe and very severe brain damage (1). This model defines phases A to F; differentiating between the phases is not only of clinical relevance, but it also has implications for health insurance coverage (Table 1). In most federal states, neurological early rehabilitation is recognized as hospital inpatient treatment (§39 SGB V); it is accounted for by means of diagnosis related groups (DRG), unless the hospitals have the status of a “specialized institution.” In this context, the importance of the procedure OPS 8-552 (“neurological-neurosurgical early rehabilitation”) needs to be emphasized, whereby the services delivered by neurological early rehabilitation are captured (Box) (3). The abbreviation OPS stands for the German coding system for operations and procedures (Operationen- und Prozedurenschlüssel). After a duration of stay of 27 days has been exceeded, services are reimbursed according to daily rates (DRG B43Z and B42Z).

The BAR's phase model and the 1995 recommendations for the neurological rehabilitation of patients with severe and very severe cerebral damage in phases B and C (1) form the basis on which the length of inpatient stays can be considered, which has been agreed by the medical service of the German statutory health insurance system (Medizinischer Dienst der Krankenkassenversicherung, MDK). For phase B, the BAR assumes a minimum treatment interval of 8 weeks to assess a patient's potential for rehabilitation (1).

Hardly any current data are available for inpatient length of stay in phase B. A review article from 1999 described the heterogeneous distribution of the length of therapy, some with rapid improvements and some with extremely lengthy courses of treatment that took up to 12 months (4). Details of the duration of treatment are described in an earlier publication from 1996 (5): 34% of patients stayed in hospital for up to 3 months, 16% for 3 to 5 months, 31% for 5 to 12 months, and 19% for longer than a year.

Our study investigates developments in the length of stay in neurological early rehabilitation units in recent years as well as the parameters that influence patients' length of stay.

TABLE 1

Six-phase model as defined by the German Federal Rehabilitation Council (Bundesarbeitsgemeinschaft für Rehabilitation, BAR)

BAR phase	Characteristics	Early rehab Barthel index	Main funding body
A	Acute inpatient treatment	–	Health insurance companies
B	Early rehabilitation of severely affected, postacute patients, for whom intensive medical therapeutic options have to be kept open; this includes patients who are being ventilated	≤30	Health insurance companies
C	Rehabilitation phase during which patients are still dependent on a high degree of nursing and medical care	30–65	Health insurance companies ^{*1}
D	Rehabilitation phase during which patients have mostly gained far-reaching independence in the activities of daily life; the best-known type of measure is the follow-up treatment	70–100	Pension insurance companies ^{*2}
E	Medical and professional rehabilitation in a Phase 2 institution; this includes outpatient services	–	Employment agency, pension insurance companies
F	Long term care to maintain functioning, delivered in specialist units	–	Nursing care and health insurance companies

The early rehab Barthel index includes "corridors" that are not authoritative. In phase B, the limit of 30 points in the early rehab Barthel index (6) is dictated by procedure OPS 8-552 (Box); the data for phases C and D are based on the literature (2). For phase D, criteria for admission to follow-on treatments follow the requirements of the Deutsche Rentenversicherung (German statutory pension insurance scheme).

^{*1}If the prognosis for a return to work is good, then the Deutsche Rentenversicherung (German statutory pension insurance scheme) is also a funding body.

^{*2}For pensioners, the health insurance company is responsible.

BOX

Minimum characteristics of neurological and neurosurgical early rehabilitation OPS 8-552 (G-DRG version 2009)

- Early rehabilitation team led by a specialist for neurology, neurosurgery, physical and rehabilitation medicine, or pediatrics and adolescent medicine with an additional qualification in neuropsychiatry, who has to have a minimum of 3 years' experience in neurological and neurosurgical early rehabilitation. The early rehabilitation team has to be able to rely on neurological or neurosurgical specialists.
- Standardized assessment of early rehabilitation to collect and evaluate functional deficits in at least 5 areas (conscious level, communication, cognition, mobility, ability to help themselves, behavior, emotions) at the outset of the treatment. The patient has a maximum early rehabilitation Barthel index after Schönle of 30 points at the outset of treatment. (The calculation of the early rehabilitation Barthel index after Schönle is in the appendix of the ICD-10-GM.)
- Weekly team meetings with weekly documentation of treatment results so far and further treatment objectives.
- Mobilizing and therapeutic care delivered by specially trained nursing staff with expertise in neurological-neurosurgical early rehabilitation.
- Availability and application of the following therapeutic measures: physiotherapy, physical therapy, ergotherapy, neuropsychology, speech therapy/orofacial therapy and/or therapeutic care (training for patients in how to wash themselves, dress themselves, eat, continence training, orientation training, swallowing training, management of tracheostomy, measures requiring isolation) in patient based, different combinations of an average of at least 300 minutes daily in the context of neurological-neurosurgical early rehabilitation. If 2 or more staff are deployed simultaneously, the minutes can be summed up together.
- Simultaneous (continuous or intermittent) acute medical diagnostics or treatment are to be coded separately.
- OPS 8-552 does not include geriatric early rehabilitation complex treatment (8-550ff), interdisciplinary, and other early rehabilitation (8-559ff), or physical-medical complex treatment (8-563ff).

TABLE 2

Diagnosis related groups of the early rehabilitation cases, in descending order of frequency

Diagnosis related group	n	Proportion (%)	Male/female	Mean age	Mean length of stay
1. Cerebral ischemias	824	40.0	441/383	69.7 (12.0)	42.1 (33.2)
2. Traumatic brain injury	426	20.7	308/118	52.3 (20.2)	47.6 (37.3)
3. Intracerebral hemorrhage	304	14.8	186/118	62.9 (13.7)	48.7 (33.8)
4. Subarachnoid hemorrhage	155	7.5	76/79	54.9 (13.1)	45.5 (34.7)
5. Hypoxic damage	65	3.2	46/19	54.6 (15.1)	56.5 (41.8)
6. Neoplasias	56	2.7	26/30	61.9 (14.5)	38.8 (36.0)
7. Inflammatory and infectious disorders (meningitis, encephalitis, multiple sclerosis)	56	2.7	28/28	54.9 (15.8)	46.8 (40.8)
8. Spinal trauma/paraplegia	38	1.8	20/18	60.3 (17.4)	41.7 (41.3)
9. Polyneuropathies, Guillain-Barré syndrome	28	1.4	18/10	61.4 (13.2)	51.0 (55.6)
10. Other diagnoses (cumulative)	108	5.2	58/50	–	–
Total	2060	100	1207/853	–	–

Values are absolute case numbers, percentages (relative to total), sex distribution (male/female), mean age in years, and mean length of stay in days (value in parentheses is the standard deviation from the mean).

FIGURE 1

Patients' mean length of stay (in days) from 2005 to 2008. The dark bars show mean lengths of stay, the light bars show mean lengths of stay adjusted for death, transfer to an acute ward, transfer to a hospice, and discharge against medical advice. The case numbers were as follows: 2005, n=578; 2006, n=580; 2007, n=541; 2008, n=361.

Materials and methods

We included in a retrospective analysis all 2060 cases of early rehabilitation—admitted from 1 January 2005 and discharged by 31 October 2008 in the BDH-Klinik Hessisch Oldendorf (a neurological rehabilitation hospital)—that met the structural criteria of the early rehabilitation procedure OPS 8-552 (Box).

We used the software package SPSS (version 16.0) for our statistical analysis, which comprised analyses of variance (ANOVA) with post-hoc LSD tests, *t*-tests, and Pearson correlations. The results include the means and standard deviations in parentheses. To assess morbidity, the early rehab Barthel index (6) was captured for a proportion of cases. This index may assume values between –325 (severely affected early rehabilitation patient) and +100 (patient who has retained independence in the activities of daily life). Another morbidity measure is the PCCL (patient clinical complexity level) value, which is based on the complications and/or comorbidities at discharge as coded by the subdiagnoses. We also collected the coded subdiagnoses.

The lengths of stay were “adjusted” in some additional analyses, namely by the discharge types “death,” “transfer to an acute hospital,” “transfer to a hospice,” and “discharge against medical advice.” We selected this statistical method in order to mainly capture “normal” early rehab cases that were not brought to an early conclusion by complications or irregular discharges. However, in the results section we present “adjusted” as well as “unadjusted” cases.

Results

Of 2060 cases in phase B, 1207 were male and 853 female. The mean age was 62.0 years (16.7), range 14 to 97. Cerebral ischemias were the dominant diagnostic group (40%), followed by traumatic brain injury (20.7%), and intracerebral hemorrhage (14.8%) (Table 2).

During the entire study period, the mean length of stay in phase B was 44.6 (35.2) days (range 7 to 304, median=35, 25 percentile=20, 75 percentile=58). From 2005, a significant decrease was observed, from 46.8 (38.3) days to 37.5 (28.5) days in 2008 (ANOVA, $F=6.6$; $p<0.001$), but the standard deviations were high (Figure 1). Post-hoc LSD tests showed that the reduced length of stay for 2008 was significantly different from all preceding years. 44.2% of early rehabilitation cases were discharged within the first month, 32.2% within 1 to 2 months (Figure 2). 13.7% stayed for 2 to 3 months, 6.0% for 3 to 4 months, 1.9% for 4 to 5 months, and only 1.3% for 5 to 6 months. The cumulative proportion of cases with a length of stay of more than 6 months was 0.7%. Even after adjusting cases for transfers to acute hospitals, death, discharge against medical advice, and transfer to a hospice, the mean length of stay changed only slightly.

Among the types of discharge, transfer to a subsequent rehabilitation measure dominated, with 39.5%, which means that in these cases, progress in rehabilitation was achieved, so that subsequent phase C treatment

became possible (Table 3). 13.6% of cases of early rehabilitation were discharged normally, usually into care in the patient's home. In 27.6% of cases, transfer to an acute hospital became necessary as a result of a morbidity requiring intervention—for example, hydrocephalus requiring a shunt or shunt-associated complications; mortality was 0.9%, with 5 patients dying in 2005, 6 in each 2006 and 2007, and 2 in 2008.

Table 4 shows the PCCL value for 2005–2008. Most cases were of severity levels 3 and 4 (93.3%); increasingly, a shift from severity level 4 to severity level 3 was noted. In 1320 cases from 2006–2008, the early rehab Barthel index (6) at admission was measured as an additional criterion of illness severity. Table 5 shows the distribution according to ICD codes U52.0 to U52.3. In most cases, severe impairments were present in the ranges of –200 to –76 points and –75 to 30 points (a total of 96.4% in 2006–2008). However, over the years an increasing shift became obvious from the very severe cases (–200 to –76 points) to the –75 to 30 point range in the early rehab Barthel index. In 2006, 42.7% of cases were assigned to category U52.2 (–200 to –76 points) and 50% to category U52.1 (–75 to 30 points). In 2008, only 28.1% fell into category U52.2 and 71.9% into the “less severe” category U52.1.

As an additional parameter of morbidity, we analyzed the number of subdiagnoses. In 2005, the mean number of coded subdiagnoses was 13.7 (5.5); in 2006 it was 15.2 (5.9); in 2007, 14.4 (5.5); and in 2008, 15.0 (5.7). Univariate ANOVA with post-hoc LSD tests showed that in 2006, significantly more subdiagnoses were documented than in 2005 and 2007. In 2008, the number was significantly higher than in 2005 ($p < 0.01$).

Age did not correlate with length of stay. However, the severity of illness influenced the length of stay (expressed as the early rehab Barthel index and PCCL value), as did the number of subdiagnoses, sex, and diagnostic group. Univariate ANOVA with length of stay as the dependent variable and the early rehab Barthel index category (U52.x) as the independent variable showed significant differences ($F = 40.4$, $p < 0.001$), (Figure 3). This means that the lower the early rehab Barthel index, the longer the length of stay. For the PCCL value, a similar result was observed ($F = 40.6$, $p < 0.001$). Post-hoc LSD tests confirmed longer lengths of stay for PCCL value 4 than for all other PCCL values. In bivariate ANOVA, the number of subdiagnoses correlated significantly with the length of stay. The correlation coefficient was $r = 0.33$ ($p < 0.001$). For female cases, a trend was noted towards shorter lengths of stay: 42.9 (30.7) days versus 45.8 (38.0) days ($T = 1.9$, $p < 0.10$). Table 2 lists the lengths of stay for the individual diagnostic groups. These differed significantly from each other ($F = 3.1$, $p < 0.001$). Post-hoc LSD tests confirmed that cases with hypoxic cerebral damage had a significantly longer length of stay than most other diagnostic groups.

The early rehabilitation cases were coded to 60 different diagnosis related groups. The most common DRG by some margin was B42/43Z, “early

FIGURE 2

Distribution of cases over months of treatment. The dark bars show the percentage of the cases discharged in each time period. The light bars show the lengths of stay adjusted for death, transfer to an acute ward, transfer to a hospice, and discharge against medical advice

TABLE 3

Types of discharge, in descending order of frequency

Type of discharge	n	Proportion (%)
1. Transfer to subsequent rehabilitation measure	813	39.5
2. Transfer to another hospital	568	27.6
3. Discharge to a nursing care institution	374	18.2
4. Regular discharge	280	13.6
5. Death	19	0.9
6. Discharge against medical advice	4	0.2
7. Transfer to a hospice	2	0.1
Total	2060	100

TABLE 4

Patient clinical complexity levels (PCCL)

PCCL	0	1	2	3	4	Total
2005	16	1	30	88	443	578
2006	12	2	21	78	467	580
2007	7	4	21	202	307	541
2008	7	8	17	157	172	361
Total	42	15	89	525	1389	2060

TABLE 5

Early rehabilitation Barthel index after (6)

ICD-GM code	Point range in early rehab Barthel index	2006	2007	2008	Total period 2006–2008
U52.0	>30	2.0% (11)	0	0	0.8% (11)
U52.1	–75 to 30	50.0% (275)	63.3% (232)	71.9% (187)	59.5% (785)
U52.2	–200 to –76	42.7% (235)	35.1% (179)	28.1% (73)	36.9% (487)
U52.3	<–200	5.3% (29)	1.6% (8)	0	2.8% (37)

ICD-GM, International Classification of Diseases, German Modification; absolute case numbers in parentheses

rehabilitation in neurological disorders and impairments lasting more than 27 days,” in 67.3% of all cases, followed by B42B, “early rehabilitation in neurological disorders and impairments lasting up to 27 days without complex neurological treatment of acute stroke,” in 11.2% of cases (*Table 6*).

Discussion

Neurological early rehabilitation in phase B is an integral part of the care of severely affected neurological and neurosurgical patients. In the context of the six-phase model devised by the BAR, phase B immediately follows treatment in the acute setting. The BAR assumes a minimum treatment duration of 8 weeks in phase B in order to assess the rehab potential of severely affected patients (1). For the entire study period (2005–2008), the mean length of stay for 2060 early rehabilitation patients who met the structural characteristics of the OPS 8-552 was 44.6 days; however, the range was wide. The minimum length of stay of 8 weeks as stipulated by the BAR was adhered to in 76.4% of cases studied. However, in view of the wide range it is obvious that substantial individual differences have to be borne in mind when considering the length of stay. The diagnosis is of crucial importance. Cases with hypoxic brain damage are notably above the overall average, at 56 days.

By way of an explanation of the reduction in length of stay from 2005 to 2008, the decrease in morbidity noted in the study sample is a main factor. Although the number of subdiagnoses increased during the study period, the other essential morbidity parameters—especially the early rehab Barthel index and the PCCL value—showed a decrease in morbidity. This surprising finding contradicts the perception of many early rehabilitation units, which have complained about increasing morbidity in their patients. We think that this seeming discrepancy is primarily due to a selection effect by means of the early rehabilitation procedure itself. The present study included only cases that met the structural characteristics of the OPS 8-552. This means that the patients have to be sufficiently resilient to cope with at least 300 minutes of therapy per day (*Box*). This means that the procedure cannot be coded in very severely affected patients. It also should be borne in mind that especially cases requiring intensive care or ventilation are not coded with the OPS 8-552, but with, for example, the OPS 8-980 (“intensive medical complex treatment”). This also means that particularly severe cases with a very low early rehab Barthel index were not included in our analysis. The number of cases requiring ventilation in the BDH hospital notably increased in the study period. In 2005, merely 14 221 ventilation hours were recorded, whereas in 2006, the annual number had risen to 29 947, and in 2007 to 28 887 (7).

The introduction of the DRG system itself is likely to have a secondary role in reducing the length of stay when the morbidity parameters are taken into consideration. Any influence would only be indirect, via the

Length of stay on the basis of early rehabilitation Barthel index
^{*1} p<0.05
^{*2} p<0.001

FIGURE 3

TABLE 6

Diagnosis related groups resulting from early rehabilitation cases, in descending order

G-DRG	Explanation	n	Frequency (%)
1. B43Z and B42Z	Early rehabilitation in neurological disorders and impairments, longer than 27 days	1387	67.3
2. B42B	Early rehabilitation in neurological disorders and impairments up to 27 days, excluding complex treatment of acute stroke	230	11.2
3. W40Z	Early rehabilitation in multiple trauma	72	3.5
4. B61Z	Acute disorders and injuries of the spinal cord except for transplantation	55	2.7
5. B70E	Apoplexy without neurological complex treatment of acute stroke, with intracranial hemorrhage, without complicated intracranial hemorrhage or with systemic thrombolysis or with other neurological complex treatment of acute stroke, up to 72 hours	54	2.6
6. B70B	Apoplexy with neurological complex treatment of acute stroke, longer than 72 hours, without intracranial hemorrhage or neurological complex treatment of acute stroke, longer than 72 hours, with complicated intracranial hemorrhage	34	1.7
Others	–	228	11.0
Total		2060	100

The explanations relate to the German DRG version of 2009

selection effect explained earlier, which set in once the early rehabilitation procedure 8-552 had been introduced.

In our opinion, further causes of the reduced length of stay—in addition to the selection bias—may include the increased concentration of therapeutic services—a daily minimum of 300 minutes of therapy is required—and in stricter granting of services in neurological early rehabilitation. Although this assessment cannot be validated on the basis of the current data, some aspects of this development are mentioned in a publication by Wallesch (8). In our experience, an earlier change to the less well financially compensated treatment phase C is often enforced, mainly at the expense of the health insurers.

With regard to the question of whether the DRG system can adequately reflect early rehabilitation services, the following is worth mentioning: Since—in spite of the coding of the OPS 8-552—a total of 60 diagnosis related groups were recorded, the system does not (yet) have sufficient focus on the requirements of early rehabilitation. However, it should be pointed out that by means of DRG B42Z and B43Z, depending on the version of the DRG, reimbursement occurs following daily rates after 27 days. In our view, this is appropriate because the effort and expense for the treatment—for example, with regard to the daily requirement of 300 minutes' therapy—remain constant. We think that it is undisputed that patients undergoing neurological early rehabilitation are so severely affected that the hospital's special funds will need to be put to use, and morbidity data confirm this. As a secondary finding, a trend was noted for female cases to spend less long in phase B than male cases. Since the subsequent phases C and D have shown the reverse ratio for the sexes, owing to

psychosocial contextual factors (10), this result may hint at a more favorable rehabilitation potential in women, which is confirmed by the literature, even if only marginally (11).

In conclusion, the current study has shown a notable reduction in length of stay in neurological-neurosurgical early rehabilitation compared with the mid-1990s. The 8 week “observational interval” proposed by the BAR as the minimum length of treatment seems sufficient to capture about three quarters of early rehabilitation cases in the study, although the range is wide.

A limitation of the study is its case based, and not patient based, perspective. This means that the study cannot be used to assess the quality of results or the effectiveness of the neurological-neurosurgical early rehabilitation. This is not possible for the simple reason that we did not conduct a controlled, randomized study. Further, especially multicenter, studies are needed in order to elucidate this aspect further.

Conflict of interest statement

Professor Rollnick is medical director and Diplomkaufmann [business graduate] Janosch is managing director of the BDH-Klinik Hessisch Oldendorf, a hospital that specializes in neurological early rehabilitation.

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KEY MESSAGES

- Neurological early rehabilitation is used to treat patients with severe and very severe cerebral trauma.
- Between 2005 and 2008, the length of stay in such rehabilitation units fell significantly from 46.8 days to 37.5 days.
- The reduced length of stay can be explained by reduced morbidity (selection effect of the early rehabilitation procedure OPS 8-552).
- Although neurological early rehabilitation is integrated in the system of flat rates for diagnosis related groups, the majority of cases is still reimbursed according to daily rates (B43Z and B42Z).

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